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(54) **A drill screw**

(57) A drill screw comprises an elongated threaded stem having a driving head at one end and a drill bit at the opposite end, the drill bit having a pair of axially extending flutes located oppositely with respect to the axis of the stem, each of the flutes having a cutting surface 10 which is deviated from the axis 0, each of the cutting surfaces having an inwardly concave bottom with respect to an imaginary reference plane 9 deviated from the axis but extending in parallel therewith, the cutting surface including a cutting edge 14 formed by its front edge and a cutting blade 15 formed by its side edge, wherein the cutting edge and blade are on the reference plane, and each of the cutting edge and blade having a rake formed by the cutting surface. Each flute has two mutually angled drag surfaces 11,12, the former extending axially, the latter joining the cutting edge to form a chisel edge 13. The drill bit is formed between complementary shaped pressing dies.

FIG.4

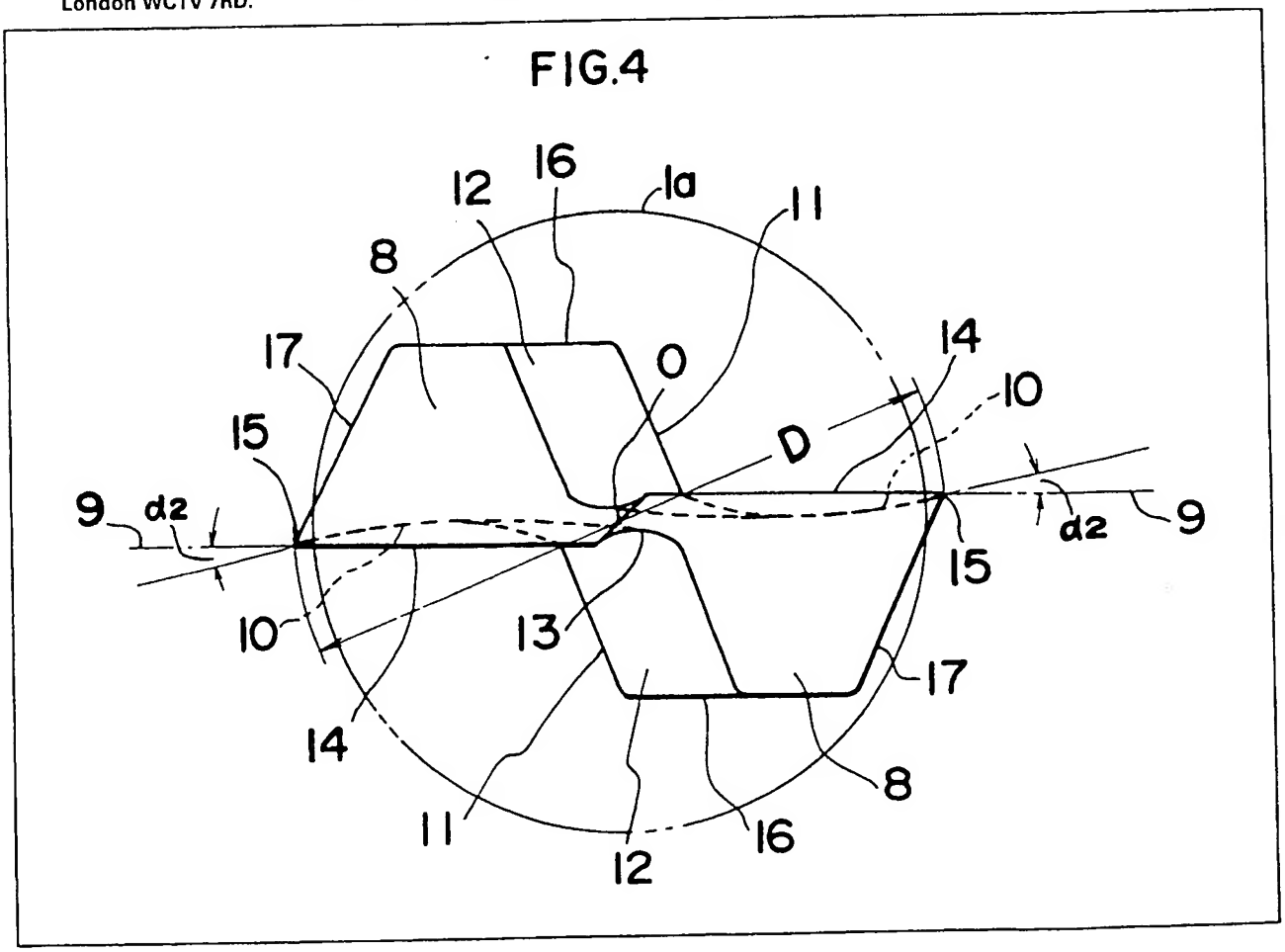


FIG.1

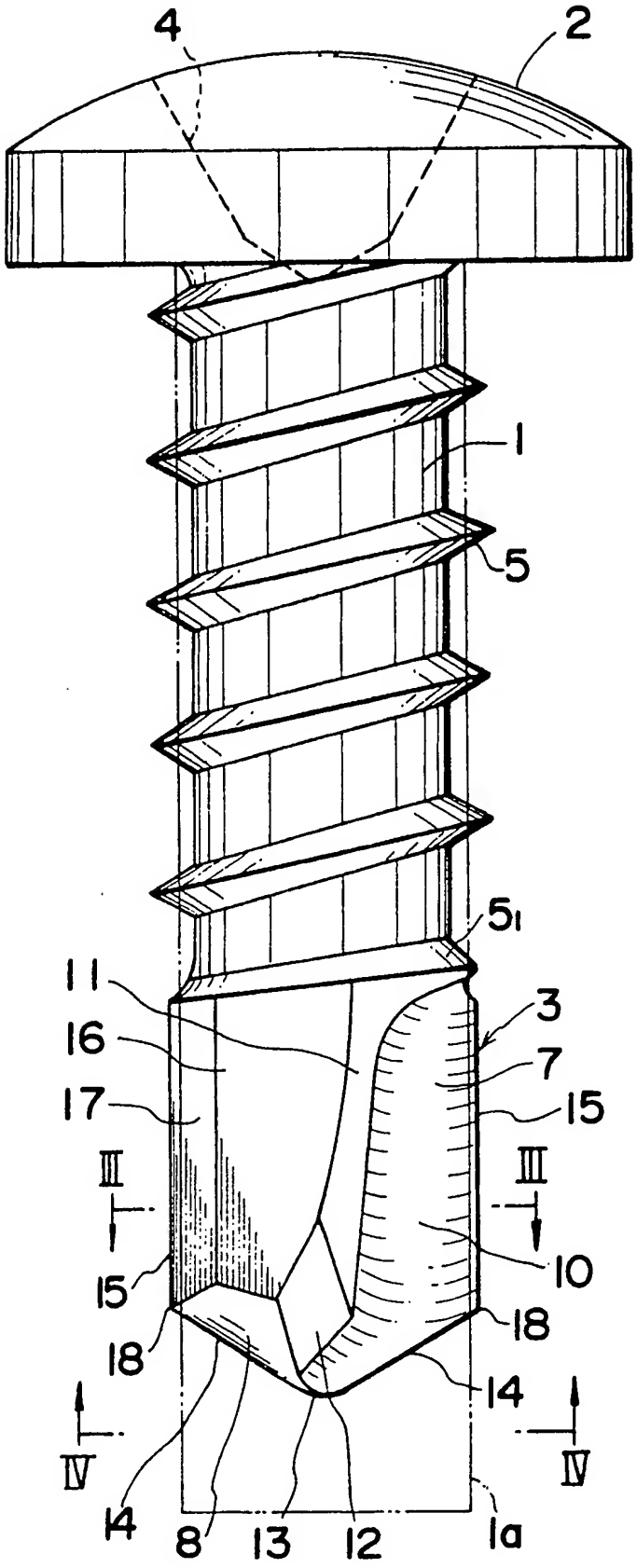

4
2
1
5
5₁
11
16
17
III
15
18
IV
14
8
13
12
1a
3
7
15
III
10
18
14
IV

FIG.2

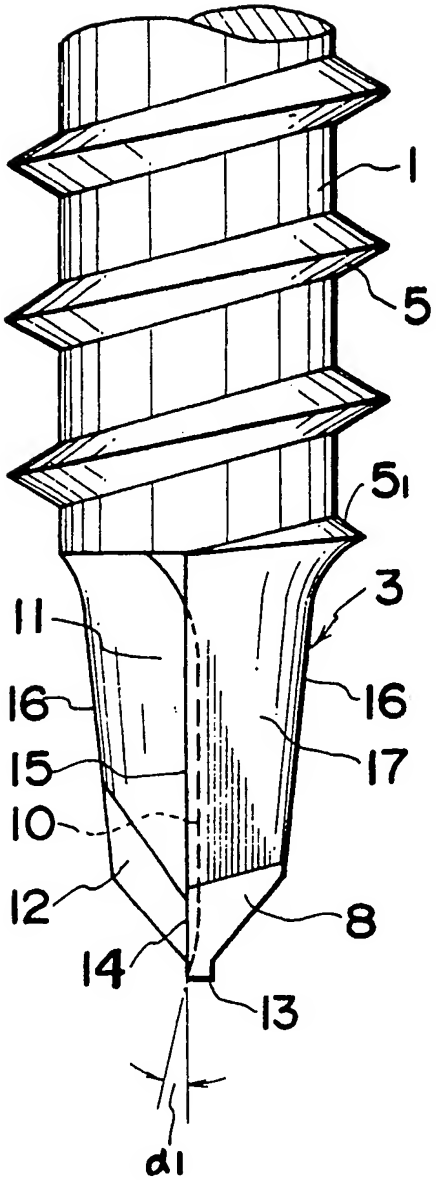
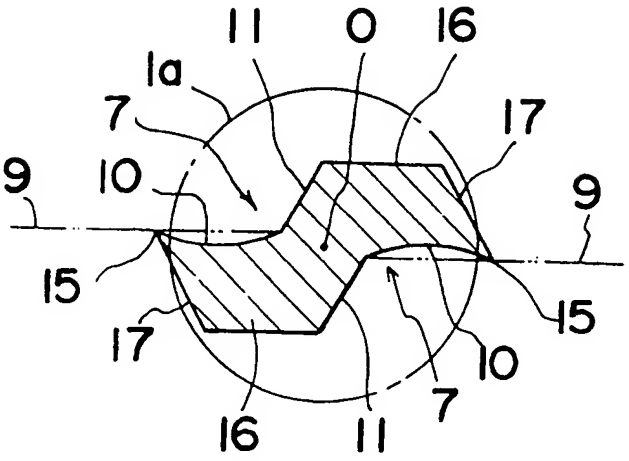

1
5
5₁
3
11
16
16
15
17
10
12
8
14
13
d1

FIG.3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0
16
1a
7
17
9
10
9
15
15
17
10
7
16
11

FIG.4

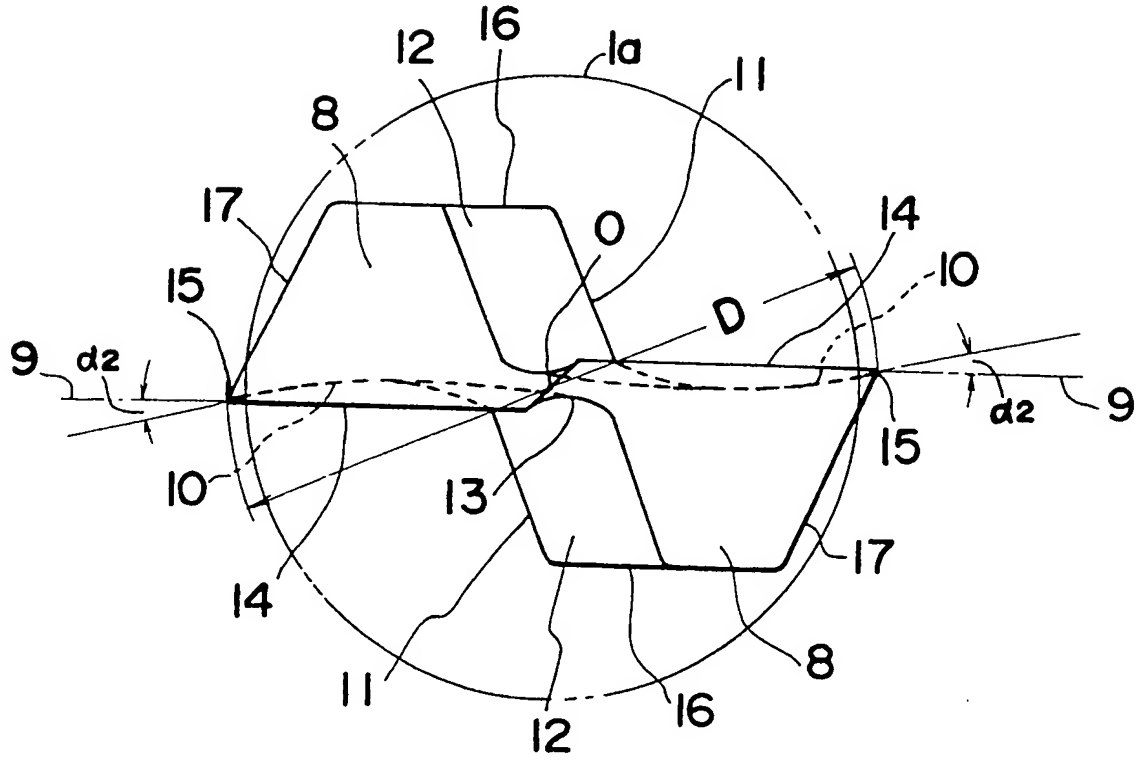
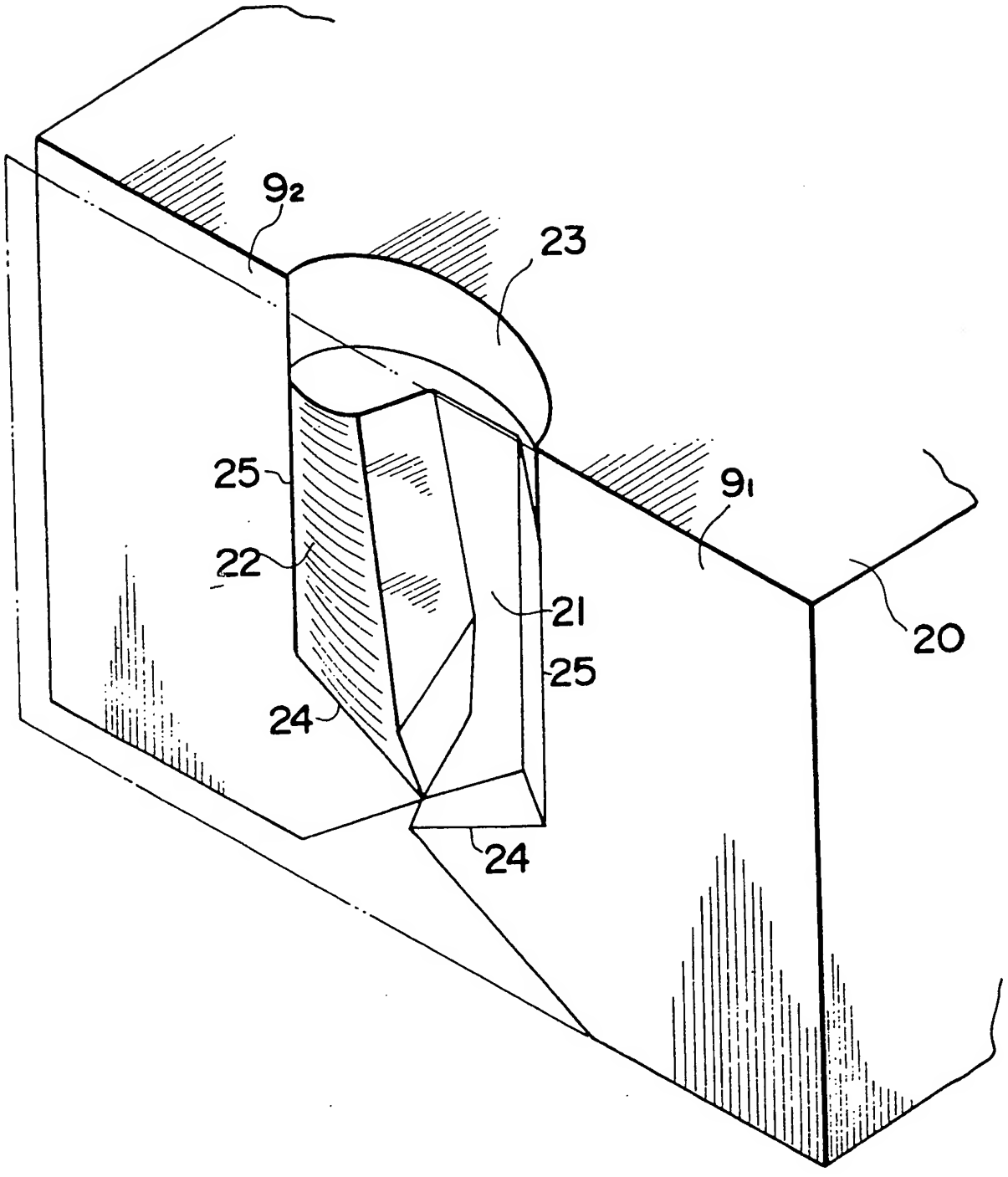

16
12
1a
11
8
17
0
14
15
10
D
9
d2
d2
9
15
10
13
17
14
8
11
16
12

FIG.5



SPECIFICATION

A drill screw

The present invention relates to a drill screw for producing a threaded hole and allowing itself to anchor therein. More particularly, the present invention relates to a drill screw of such nature whose drill head or bit is shaped so as to allow the same to be cold forged.

In general, drill screws can be classified roughly into two types; the first type has a drill bit shaped by a cutting machine such as a milling machine, and the second type has a drill bit shaped under pinch pointing or cold forging. With increasing demands for drill screws, the second type tend to outnumber the first type because its superior productivity and economy.

To increase the drilling capability most of the forged screws is shaped so as to have relief and twist in its cutting surface as is in conventional all-purpose drills. Examples of this type are disclosed in U.S. Patent No. 3,079,831 and U.S. Patent No. 3,241,426 (Japanese Patent Publication No. 45-24728). However, difficulties arise as to how to fabricate a molding die adapted to shape such configuration under cold forging. Even if it is well fabricated, the die cannot withstand a long use. A frequent replacement will be needed.

To overcome the difficulties pointed out above, there is a proposal for producing a flat cutting surface free from any relief and twist, wherein the cutting surface extends axially of the drill. This facilitates to fabricate a die and prolongs its life. Typical examples of this type are disclosed in U.S. Patent NO. 3,463,045 (Japanese Patent Publication NO. 47-2562), U.S. Patent No. 3,395,603 (Japanese Patent Publication No. 48-13139) and U.S. Patent No. 3,710,676.

However, this proposal only aims at securing the easiness of fabricating a die, and fails to consider the function of a drill screw. As a result, the drill screws shaped in such dies must have a reduced drill capability.

The present invention is directed toward solving the problems pointed out with respect to the known drill screw and seeks to provide a drill screw that can be cold forged without trading off its drilling function.

According to the present invention, a drill screw comprises an elongated threaded stem having a driving head at one end and a drill bit at the opposite end, the drill bit having a pair of axially extending flutes located oppositely with respect to the axis of the stem, each of the flutes having a cutting surface which is deviated from the axis, each of the cutting surfaces having an inwardly concave bottom with respect to an imaginary reference plane deviated from the axis but extending in parallel therewith, the cutting surface including a cutting edge formed by its front edge and a cutting blade formed by its side edge, wherein the cutting edge and blade are on the reference plane, and each of the cutting edge and blade having a rake formed by the cutting surface.

The invention will be further described with reference to the accompanying drawings, in which:

Figure 1 is a front view showing a drill screw according to the present invention;

Figure 2 is a front view particularly showing the drill bit and the stem;

Figure 3 is a cross-section taken along III-III in Figure 1;

Figure 4 is an enlarged end view of the drill screw, viewed along IV-IV in Figure 1; and

Figure 5 is a perspective view of a die for shaping the drill screw according to the present invention.

As shown in Figure 1, a drill screw according to the present invention includes an elongated threaded stem 1 having a driving head 2 at one end and a drill bit 3 at the opposite end. The driving head 2 includes a groove 4 adapted to receive a driving tool, such as a screw driver, whereby the drill screw is as a whole turned. The reference numeral 5 indicates threads spirally extending around the cylindrical surface of the stem 1, from the driving head 2 to the drill bit 3. The root diameter of the thread is smaller than the maximum diameter of the drill bit 3, but the outside diameter thereof is larger than the maximum diameter of the drill bit. The reference numeral 5_1 indicates a thread portion located adjacent to the drill bit 3, which thread portion has a diminishing height so as to allow the threaded stem 1 to smoothly advance into the hole in the workpiece. The thread 5 is produced by a rolling process.

The drill bit 3 includes two flutes 7 and a pair of cutting lips 8. The flutes 7 extend axially of the drill screw, but each flute is located in opposite positions with respect to a dead center 0. The cutting lips 8 also extend opposedly with respect to the dead center.

Referring to Figures 3 and 4, there are two imaginary parallel reference planes 9 each of which passes at a distance fom the axis of the drill screw. The flute 7 includes a cutting surface 10, a first drg surface 11 and a second drag surface 12. The cutting surface 10 is defined by the reference plane 9 located adjacent thereto. The first drag surface 11 intersects at an obtuse angle with the reference plane 9 located adjacent thereto such that their intersection extends axially of the drill screw. The second drag surface 12 intersects with another reference plane 9 as well as with the first drag surface 11, the second drag surface extending up to the edge along which the cutting lips 8 meet. Bt virtue of the provision of the second drag surface 12 a chisel edge 13 is formed in the cutting lips 8.

As best shown in Figure 3 the cutting surface 10 has an inwardly concave bottom, a cutting edge 14 in front and a cutting blade 15 at one side. The cutting edge 14 and blade 15 are located on the reference plane 9, and form rake angles a_1 and a_2 against the cutting surface 10, respectively.

The reference numeral 1_a indicates a cylindrical blank from which the threaded stem 1 and the drill bit 3 are shaped in one piece. When the blank is compressed in a die as described below, lands 16 are formed in opposite places against the cutting surfaces 10. Each land is trapezoidal in cross-section, and by virtue of this trapezoidal shape the cutting blade 15 can acutely protrude from the periphery of

the blank 1a. Another advantage is that the cutting blade 15 is relieved at its back 17 in the direction in which the drill screw is turned. In addition, an extremely acute edge 18 is formed at the intersection of the cutting edvge 14 and the cutting blade 15 as shown in Figure 1. The distance between the opposite cutting blades 15 is the maximum diameter (D) of the drill bit 3. As described above, the diameter (D) is between the root diameter of the threaded stem 1 and the outside diameter of the thread.

Referring to Figure 5 the process of shaping a drill screw will be described:

Before forming the threads 5, the driving head 2 is formed at an end of the blank 1a. Then, the drill bit 3 is shaped at the opposite end by pinch pointing or forging with the use of dividable dies, which are symmetrically constructed. The reference numeral 20 indicates a halved die adapted to shape the symmetrical half of the drill bit 3. The die 20 has two cut faces 9_1 and 9_2 which are in parallel with each other, but the cut face 9_2 is slightly withdrawn with respect to the cut face 9_1. As shown in Figure 5, the die 20 has a die cavity in which a hill 22 and valleys 21 and 23 are produced. The valley 21 is concave with respect to the level of the cut face 9_1, and conform to the shape of the cutting lips 8 and the lands 16. The hill 22 is convex with respect to the cut face 9_2 and conform to the shape of the cutting surface 10. The cutting edge 14 and the cutting blade 15 are shapped by edges 24 and 25 which define the opening of the die cavity, and the edges 24 and 25 are located on the cut faces 9_1 and 9_2. A semi-circular concave 23 is produced so as to support the cylindrical blank 1a when the same is compressed in the die.

CLAIMS

1. A drill screw comprising an elongated threaded stem having a driving head at one end and a drill bit at the opposite end, said drill bit having a pair of axially extending flutes located oppositely with respect to the axis of said stem, each of said flutes having a cutting surface which is deviated from said axis of said stem, each of said cutting surfaces having an inwardly concave bottom with respect to an imaginary reference plane deviated from said axis of said stem but extending in parallel therewith, said cutting surface including a cutting edge formed by its front edge and a cutting blade formed by its side edge, wherein said cutting edge and blade are on said reference plane, and each of said cutting edge and blade having a rake formed by said cutting surface.

2. A drill screw as defined in Claim 1, further comprising a land having a trapezoidal cross-section at the back of each of said cutting surfaces.

3. A drill screw according to claim 1, substantially as hereinbefore described with reference to the accompanying drawings.

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